MULTILAYER SOLE FOR SPORT SHOES

This application is a continuation of application Ser. No. 07/995,083 filed Dec. 22, 1992, now abandoned.

OF THE INVENTION

The present invention relates to soles for sport shoes made with a laminated profile comprising multiple layers performing distinct functions, respectively. This sole is mounted on an upper and may or may not incorporate a projecting outer heel-piece in its rear portion.

BACKGROUND OF THE INVENTION

In shoes particularly intended for mountain sports, e.g., cross-country skiing, Nordic hiking, and mountain hiking in general, attempts have always been made to produce soles making it possible to obtain, simultaneously, torsional stiffness properties in relation to the longitudinal axis of the sole combined with good flectional properties, in particular in the area of the metatarsals.

This goal is sought most notably in cross-country skiing and Nordic hiking, where the boot cooperates with the ski and must provide optimal guidance of the latter.

Furthermore, longitudinal flexibility of the sole of the boot is indispensable so as to allow smooth extension of the foot not only during actual cross-country skiing or Nordic hiking, but also when the skis are removed, to permit walking freely.

The situation is the same for boots designed specifically for walking.

Moreover, and precisely in the case of walking shoes or ski boots designed to be used for walking, even of only occasionally, attempts have been made to produce soles having the aforementioned properties, but which can also provide a certain level of comfort and which damp the points of impact produced by contact of the boot with the ground, while restoring energy.

French Patent No. 2 520 886 relates to an athletic shoe comprising a laminated sole composed of a first layer, or contact sole, whose upper part receives a second, or inserted flexible layer, in a central plane of which a reinforcement element is inserted in the area of the heel-piece and extending toward the arch.

In this case, the efficiency of the second, comfort layer is impaired because of the presence of the reinforcement element in its central plane.

Moreover, the presence of a lower portion of the insert positioned between the reinforcement element and the contact sole increases proportionally the height and weight of the assembly.

In addition, currently-marketed mountain boots include a model sold under the "HANWAG" label, which offers a sole composed of an outer contact sole on which are superposed, in succession, a shock-absorbing layer, then a very rigid assembly insole fitted with an anti-torsion insert.

Another boot, currently marketed under the tradename "ASOLO" differs basically in that the shock-absorption layer is confined to the heel area and is housed in a corresponding recess provided in the outer contact layer.

In these latter cases, the principal disadvantage lies in the fact that the rigid layer is in direct contact with the foot and imparts excessive flectional rigidity to the sole. Furthermore, shock waves are felt in more pronounced fashion by the foot.

In French Patent No. 2 556 569, applicants have also proposed a solution consisting of producing an outer sole by using at least two plastic materials having different mechanical properties and by applying the duplicate-molding technique.

In fact, this sole comprises a stiffening element, or shank, made of a rigid plastic material and elastically deformable, which incorporates an area of flection, at least in the metatarsal-phalangeal area, in the form of spaced transverse plates separated by bridges having a lesser thickness and on which a flexible plastic, elastically deformable material is added through a duplicate-molding process. The bridges comprise openings through which the flexible duplicate-molded material can penetrate and are designed to break while making the rigid plates separate from each other when the sole is first used, the bridges then being connected simply by the flexible plastic material.

This solution has proved to be costly, given the complexity of the mold made for that purpose and of the simultaneous-injection equipment used; furthermore, this solution offers no comfort layer.

What is sought is precisely the following:

- obtaining greater walking comfort which is not neutralized by a stiffener inadequately arranged in the sole;
- improving shock-absorption and ground-traction properties;
- reaching a compromise between the lightest sole possible and a sole offering optimal ground traction, abrasion resistance, and torsional stiffness properties, while remaining relatively supple when flexed.

This stiffness can not be achieved using soles made only of rubber, since they would have to be too thick and, consequently, too heavy. Moreover, it is difficult to control with precision the rigidity of a rubber sole, in particular in different directions.

In addition, for purposes of standardization and cost savings, a modularly-variable sole design is sought, which can be easily adapted at minimal cost to different uses and sports, i.e., mountain sports, golf, cycling, etc.

SUMMARY OF THE INVENTION

The present invention is intended to overcome the aforementioned disadvantages and to achieve the following results:

- produce a sole incorporating a modularly-variable design and exhibiting the sought-for properties of traction on the ground, abrasion resistance, and torsional and flectional rigidity, so as to fulfill the extreme segmentation requirements in high- and medium-altitude mountain hiking, or in skiing in general or any other sport:
- enhance performance by applying the following principles:
  - for a high-performance shoe, approximate a "barefoot" configuration;
  - the shoe must be as light as possible;
  - the shoe must allow natural foot motion;
  - the shoe must damp or distribute the impact points while restoring energy;
  - it must allow walking on all types of ground;
  - it must prevent traumas, i.e, by
    - not disturbing the natural movement of the foot;
    - not cutting off sensations generated by the ground;
    - not cutting off blood circulation;
    - restoring the pumping-action feeling during walking (blood circulation problem).

To these ends, the present invention concerns a sole for a sport shoe incorporating a laminated profile comprising

several layers performing different functions respectively, this sole being surmounted by an upper and optionally comprising, an outer heel-piece on its rear portion.

It is characterized by the fact that it comprises at least three layers arranged in the following way:

- an outer, or contact, layer with determinate properties of flexibility, gripping, and abrasion-resistance which allow, simultaneously, good foot extension, good ground traction, and a high level of resistance to wear;
- an upper, or comfort, layer located directly beneath the foot, which exhibits elastic shock-absorption properties and which is assembled directly on a surface of the assembly insole of the boot upper, or by means of an assembly insole;
- an intermediate layer or rib of the sole, arranged directly between the upper part of the contact layer, by one of its faces, and the lower part of the comfort layer, by its other face, and exhibiting controlled torsional and flectional rigidity, and which provides simultaneously for the distribution of the shock areas sensed by the contact layer and their diffusion over the comfort layer, before coming in contact with the foot.

This construction incorporating three distinct layers, each of which has one or more well-determined functions, provides a modularly-variable sole design in which the integral functions may be changed by modifying a single layer; this is of particular importance for the design and manufacture of these soles.

Moreover, placing the comfort layer directly between the foot and the "rib" layer prevents this rib layer from interfering with comfort, and thus gives optimal comfort.

Finally, the effectiveness of the outer, or contact, layer is improved because the rib layer comes into contact and cooperates directly with this outer layer, the rib layer thus constituting, for the contact layer, a kind of framework which prevents generalized deformations of the contact layer, in the manner of the radial casing of an automobile tire, and allowing the use of softer, and thus more adherent, rubbers.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be better understood and other features will be brought to light by virtue of the following description provided with reference to the attached drawings, wherein several embodiments of the invention are shown by way of example, and wherein:

FIG. **1** is a side view of a sport shoe fitted with a sole according to the invention;

FIG. **2** is a transverse cross-section of the shoe along line II—II in FIG. **1**;

FIGS. **3** and **4** are top and side views, respectively, of an embodiment of an upper comfort layer designed to be mounted in combination with an intermediate rigid, or rib, layer and a low ground-contact layer (not shown), so as to form the sole according to the invention;

FIGS. **5** and **6** illustrate, respectively, two embodiments of intermediate rigid, or rib, layers;

FIGS. **7** and **8** are longitudinal cross-section and top views, respectively, of an embodiment of a contact layer and of a rigid, or rib, layer (the comfort layer is not shown);

FIGS. **9**, **10**, and **11** show, in longitudinal cross-section, top view, and longitudinal cross-section, respectively, two embodiments of a rigid intermediate layer and a contact layer obtained by duplicate molding (the comfort layer is not illustrated);

FIG. **12** is a longitudinal cross-section of a complete sole with a special embodiment of the heel-piece;

FIG. **13** is a schematic bottom plan view of a special embodiment of a ground-contact layer;

FIG. **14** is a bottom plan view of another embodiment of a ground-contact layer;

FIGS. **15** and **16** illustrate, in perspective and in transverse cross-section along line XVI—XVI, respectively, a triple-layer sole made from two materials, according to a special embodiment;

FIG. **17** is a partial perspective view of one end of a sole (comfort layer not shown), illustrating the incorporation of an insert in the intermediate rigid, or rib, layer; and

FIG. **18** is a partial representation of a longitudinal cross-section of a sole showing the incorporation of studs in the intermediate rigid, or rib, layer (comfort layer not shown).

DESCRIPTION OF THE PREFERRED EMBODIMENT

The sport shoe **1** shown in a first embodiment in FIGS. **1** and **2** comprises an outer sole **2**, on which an upper **3** is mounted, this upper incorporating conventionally an opening allowing insertion of the foot **4**, this opening being fitted with a closure system **5**, e.g., a lacing system. The rear part of the sole **2** comprises a heel **6**.

The sole **2** has a laminated profile, as shown in FIG. **2**, comprising several layers fulfilling distinct functions.

According to the invention and to the present embodiment, the sole **2** comprises three layers **7**, **8**, **9** arranged in the following manner:

- an outer, or contact, layer **7** with properties of flexibility, gripping, and abrasion-resistance which allow, simultaneously, good foot extension, good ground traction, and a high level of resistance to wear;
- an upper or comfort layer **8** placed directly beneath the upper, **3**, and thus the foot **4**, which has elastic shock-absorption properties and which is assembled directly on a surface of the assembly insole **3***a* of the upper **3** of the boot **1**, or by means of an assembly insole (not shown);
- an intermediate layer or rib **9** of the sole **2**, arranged directly between the upper part of the contact layer **7**, by means of one of its faces **9***a*, and the lower part of the comfort layer **8**, by means of its other face **9***b*. This layer **9** exhibits controlled torsional and flectional rigidity, assuring both distribution of the shock areas sensed by the contact layer **7** and their diffusion over the comfort layer, before contact with the foot **4**.

The comfort layer is made either of a flexible material of uniform density, or a material whose density gradually increases from its upper to its lower part, which is in contact with the rigid intermediate rib **9**.

In the embodiment illustrated in FIGS. **3** and **4**, the comfort layer **8** is composed of several distinct, adjoining zones, namely a first, highly-elastic zone **8***a* corresponding to the heel, a second zone **8***b* of medium elasticity corresponding to the arch and stimulating blood flow, and a third zone **8***c* of low elasticity controlling walking.

According to one embodiment, in particular under torsion, the rigidity of the intermediate layer, or rib, **9** has a uniform value at all points, this value being suitably selected during manufacture as a function of the intended use of the shoe (FIG. **5**).

This layer **9** can also be constituted by a rib **9**A composed of a plurality of zones **9***a*, **9***b*, **9***c* extending on either side of